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SPIDERS FROM DIEGAN COASTAL SAGE SCRUB (ARACHNIDA: ARANEAE)

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Abstract.—We provide the first species list of Araneae collected exclusively from Diegan (Westman) coastal sage scrub (CSS). Specimens (n = 14,553) were collected from pitfall trap and vacuum samples between June 1994 and May 1996 in sixty undisturbed coastal sage scrub plots in two regions of San Diego County, California. From these, 185 species, representing 32 araneomorph and two mygalomorph families, were separated; 160 were determined to species level. Pitfall traps provided 139 species; vacuum samples provided 76 species; 30 species occurred in both pitfall and vacuum samples but occurrence predominated in one or the other type of sample. Fifteen additional species (34 adult specimens), including members of two additional mygalomorph families, were collected either in samples from plots maintained and sampled after May 1996 or by hand between 29 May 1996 and 15 Jun 1998. Thirty-five species are believed to be new records for San Diego County, California. Four species are new records for California: *Argiope blanda* O. P.-Cambridge, *Ceraticelus phylax* Ivie & Barrows, *Opopaea bandina* Chickering, and *Theridion llano* Levi. Seven non-native species were among those collected in pitfall traps: *Metaltella simoni* (Keyserling), *Dysdera crocata* C. L. Koch, *Trachyzelotes barbatus* (L. Koch), *Trachyzelotes lyonneti* (Audouin), *Urozelotes rusticus* (L. Koch), *Zelotes nilicola* O. P.-Cambridge, and *Oecobius annulipes* Lucas. At least twenty of our 200 Diegan CSS species are believed to be undescribed.

Key Words.–Arachnida, Araneae, spiders, species list, coastal sage scrub.

California coastal sage scrub (CSS) (Davis et al. 1994) is believed to be one of the most rapidly disappearing environments in the country, resulting, for the most part, from both development and increased burning rate (Kirkpatrick & Hutchinson 1977, Minnich 1983, Chou et al. 1993). Under current urbanization rates in southern California, it seems inevitable that these ecologically sensitive CSS ecosystems will continue to recede and will soon be confined to protected reserves. Diegan CSS (Westman 1983), extending coastally from Orange County through San Diego County and into Baja California, is particularly threatened because the coastal regions in which these ecosystems thrive are highly sought after for both commercial and residential development. If for no other reason than posterity, a list of spiders of CSS is of considerable value, for it represents the only known spider survey conducted specifically in CSS, and, we believe, the most comprehensive species list of Araneae assembled for any one ecosystem in California. Our Diegan CSS list of 200 spider species, comprising approximately 80% of the families, 40% of the genera, and 15% of the species recorded from the state of California, provides a database to conservationists, developers, and arachnologists alike.

Previous general checklists of California spiders (Araneae) include those of

Moles & Johnson (1921), recording 218 araneomorph and 19 mygalomorph species, Chamberlin & Ivie (1941), recording 146 araneomorph and four mygalomorph species, and Don J. Boe, compiling an unpublished, extraordinarily comprehensive list of 1029 species in six mygalomorph and 39 araneomorph families (based on an earlier list by S. C. Johnson and W. R. Icenogle). Boe's unpublished species list (Boe 1986: Notes for the Collection and Identification of the Spiders of California; copy of manuscript deposited in the UC Riverside Science Library) was last updated in July 1989, and took into account not only literary records since Chamberlin's time, but locality data from California museum material. The above compilations catalogued the known Araneae of California.

Regional species lists include those of Coolidge (1907) who catalogued 59 araneomorph and four mygalomorph species from Santa Clara County, CA and an anonymous publication (1918) that listed 60 araneomorph and one mygalomorph species from the 'Claremont-Laguna Region' of southern California.

Among the species lists of California spiders are those that associate spider fauna with conventional monocultural agroecosystems. Tilden (1951) reported 29 species in eight araneomorph families (12 families under current taxonomic classification) associated with *Baccharis pilularis consanguinea* De Candolle in plant communities near San Jose, California. Yeargan & Dondale (1974) collected 36 species in 14 families from alfalfa fields in Yolo County (two of the species from Butte County). Carroll (1980) reported 61 species in 20 families (22 families under current classification) from citrus groves in Tulare, Fresno, and Riverside counties. Costello & Daane (1995) collected 27 species in 14 families (15 families under current taxonomic classification) from grape vineyards in the San Joaquin Valley.

Several other species lists, primarily from regions other than in California, focused on the spider fauna inhabiting heterogeneous ecosystems. The studies mentioned immediately below are more comparable to our study in that they were conducted in relatively complex plant communities or mosaics of community types in North America. Muma & Muma (1949) sampled the spider fauna from various vegetation strata within virgin Nebraska prairie (prairie, wooded ravine), finding 111 species in 15 families (18 families under current classification), and compared prairie spider composition to that found by Elliot in beech-maple forest in eastern Indiana and Lowrie in xeric dunelands near the Chicago area. Barnes & Barnes (1955) quantitatively sampled spider populations of broomsedge communities of the southeastern piedmont of North and South Carolina, Georgia, and Alabama and reported 85 species in 16 families (17 families under current classification). Muma (1973) compared occurrence and relative abundance of the ground surface spiders in four central Florida ecosystems (sand-pine dune, pine flat-woods, citrus grove, and residential), reporting 126 species in 22 families (23 families under current classification). Griswold (1977) recorded 115 araneomorph and one mygalomorph species in 17 families (20 families under current classification) from seven ecological zones during a study of Inglenook Fen near Fort Bragg in Mendocino County, California. Jennings et al. (1988) trapped 125 spider species in 15 families (16 families under current classification) in spruce-budworm infested spruce-fir forests in northern Maine. Draney (1997) discussed phenology and habitat selection of ground-layer spiders of a Georgia Piedmont floodplain agroecosystem (riparian fields and forest), reporting 112 species in 25 families.

Methods and Methods

Study Sites.—Sixty 70 × 20 m sites representative of Diegan CSS vegetation were chosen on two military bases, Marine Corps Base Camp Pendleton (MCBCP) and Miramar Naval Air Station (MNAS), San Diego County, California. Arthropods were collected by means of vacuum samples and pitfall traps from each site during each collecting period. Samples were collected in June 1994 (vacuum only), December 1994, May 1995, August 1995, December 1995, and May 1996, producing a total of 360 vacuum samples (1800 subsamples) and 300 pitfall trap samples (1500 subsamples) collected over six sampling periods.

Vacuum sampling.—At each site, arthropods were sampled along a 50 m × 1 m transect. Each transect was subdivided into 10 m segments. Each 10 m × 1 m segment was vacuumed for one min. Subsamples were pooled for each transect and arthropods were extracted from the resulting material using a modified light extracting technique as in Buffington & Redak (1998).

Pitfall sampling.—Five pitfall traps were opened for a one week period at each site during each sampling period. Each trap consisted of a 473 ml (16 oz) plastic pitfall cup (9 cm internal diameter) equipped with a funnel that narrowed to 3.2 cm and a fluid-filled collection cup (fluid composition: 2 tablespoons detergent and 1 tablespoon salt per 1 gallon water); the rim of each cup, when in position, was flush with the ground surface. A square masonite board, supported approximately two cm above the ground by small wooden stakes, was placed over each pitfall. Boards protected pitfalls from flooding during rains or from desiccation during hot weather and provided a dark refuge for arthropods. Pitfall contents were strained and transferred into 80% ethanol within 12 h of collection.

Museum Abbreviations.—AMNH = American Museum of Natural History, CAS = California Academy of Science, MCZ = Museum of Comparative Zoology.

Species List (Table 1).—Only adult specimens were considered for our species list, except in the case of the black widow spider (*Latrodectus hesperus* Chamberlin & Ivie) (discussed below). Taxonomy and placement of species within genera and families follow Platnick (1989, 1993, 1997). Species determined only to the genus level were designated as sp. #1, sp. #2, etc. Gender and number of specimens collected are provided for each species for each season collected (May/June, August, and December). Primary method of collection (Table 1) and geographical regions of collection (Table 1, Figs. 1A, 1B) are also provided for each species. Table 1 is the pivotal aspect of the manuscript and should be referred to throughout the course of the text.

Specimens Examined.—A total of 14,558 specimens (5416 adults) from both pitfall and vacuum samples from MNAS and MCBCP were examined (including five specimens collected by pitfall or vacuum method after May 1996) in addition to 29 hand collected adult specimens (the latter are not reflected in specimen totals in Table 1 because of the method of collection used). All adults that were retained in our study collection will be deposited in the Entomology Research Museum, University of California, Riverside, as voucher specimens at the conclusion of our extended coastal sage studies.

Results and Discussion

Diegan Coastal Sage Scrub Spider Fauna.—A total of 200 separable species (Table 1) was collected from CSS communities at MCBCP and MNAS, repre-

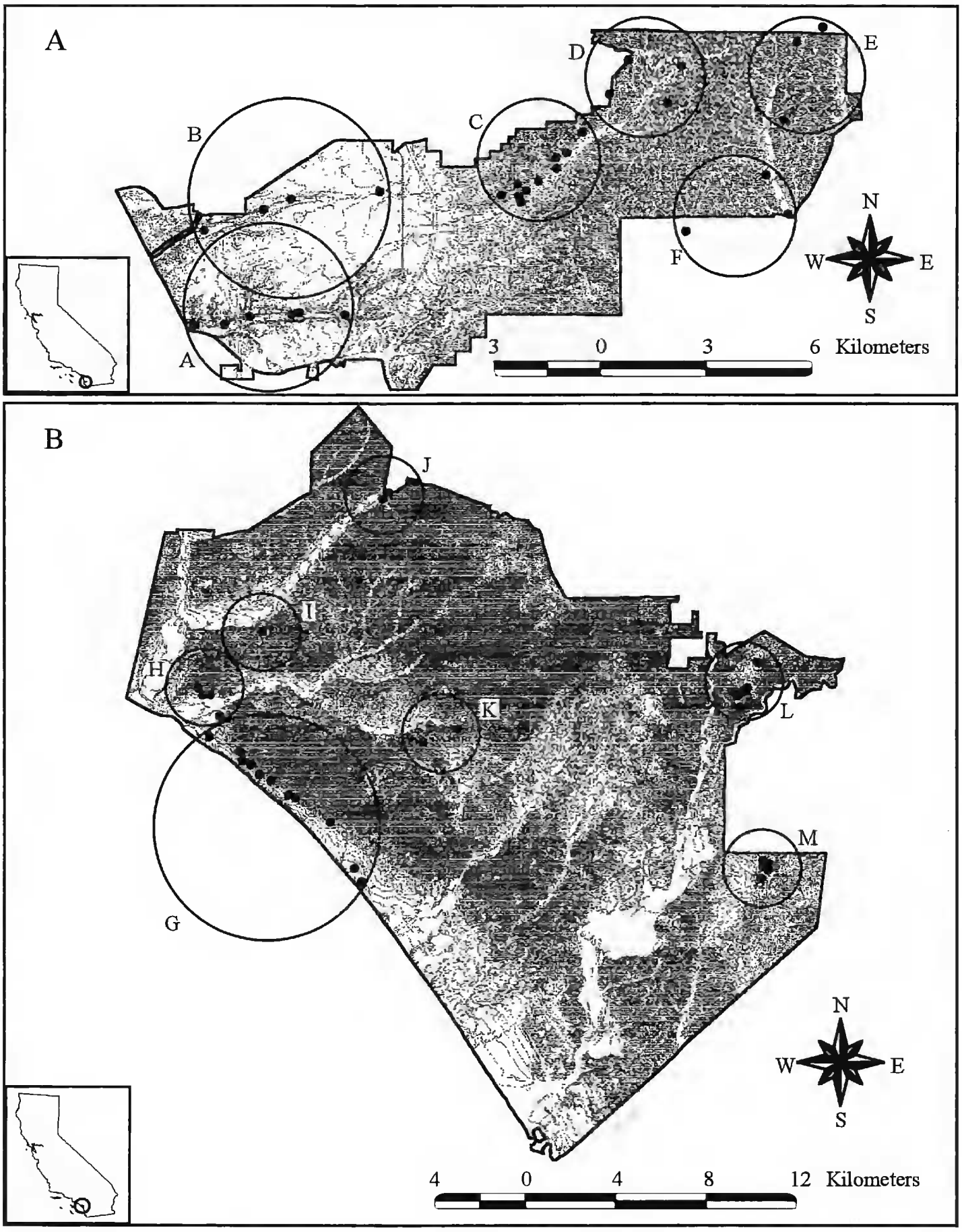

Figure 1. Maps of the areas of study in southern California. Plots are indicated by solid dots (•). Regional plot groupings are encircled by solid lines. A. Miramar Naval Air Station (regions A–F). B. Marine Corps Base Camp Pendleton (regions G–M).

senting 112 genera in 32 araneomorph and 4 mygalomorph families; 173 of these species were determined to the species level. Gnaphosidae were represented by the greatest number of species (28), followed by Salticidae (26), Theridiidae (24), Linyphiidae (21), Dictynidae (16), Araneidae (13), Thomisidae (11), Philodromidae (7), Lycosidae (6), Agelenidae, Corinnidae, and Liocranidae (each with 4),

Table 1.--A list of 200 species of Araneae from southern California coastal sage scrub (Diegan CSS) ecosystems at Miramar Naval Air Station (MNAS) and Marine Corps Base Camp Pendleton (MCBCP). Specimens from pitfall traps and vacuum samples were collected in June 1994 (vacuum samples only), December 1994, May 1995, August 1995, December 1995, and May 1996. *Emblyna linda*, *Phidippus californicus*, and females of *Argiope argentata*, *Corinna bajula*, and *Plectreurys conifera* were collected by pitfall or vacuum between December 1996 and August 1997 and are reflected in specimen totals. Specimens of 13 hand collected species are not included in totals.

Species	Geographic Regions [1]		Collection	Collection Periods [3]			Spec.
	A-F, MNAS	G-M, MCBCP	Method [2]	May/June	August	December	Total
MYGALOMORPHAE							
Ctenizidae							
Bothriocyrtum californicum (O. P.-Cambridge), 1874: 260	(D)	(M)	(h)				(2f)
Cyrtaucheniidae							
Aptostichus sp. #1 (#118) [4]		K, M	P			2m	2
Mecicobothriidae							
Hexurella rupicola Gertsch & Platnick, 1979: 31	C, E		P	8m			8
Theraphosidae							
Aphonopelma steindachneri (Ausserer), 1875: 199	(E)		(h)				(2f)
Aphonopelma sp. #1 ('*eutylenum*' type'): Prentice, 1997		(I, K)	(h)				(7f)
ARANEOMORPHAE							
Agelenidae							
Agelenopsis aperta Gertsch, 1934: 25	A, C	G, J, L, M	P		9f	1f	10
Calilena stylophora Chamberlin & Ivie, 1941: 610	A-D	G-I, K-M	P	1f	27m 9f	4m 4f	45
Hololena dana Chamberlin & Ivie, 1942: 213	A	H	P			2m	2
Rualena balboae (Schenkel), 1950: 82	B		P			1m 1f	2
Amaurobiidae							
[NN, SD]*Metaltella simoni* (Keyserling), 1877: 358		H	P	1m			1
Zanomys californica (Banks), 1904: 343	A		P			1f	1
Anyphaenidae							
Teudis mordax (O. P.-Cambridge), 1896, in 1889-1902:182	A, C		P, V	1m 1f		1m	3
Araneidae							
Araneus andrewsi (Archer), 1951: 31		(H, M)	(h)				(1m 2f)
Araneus bispinosus (Keyserling), 1885: 34	D		V	1m			1
[SD]*Araneus detrimentosus* (O. P.-Cambridge), 1889, in 1889-1902: 26		(H, M)	(h)				(4f)
Araneus pegnia (Walckenaer), 1841: 80	C, E		V	3m 2f	1m		6
Argiope argentata (Fabricius), 1775: 443		G, H, K, M	V	3m	1m 1f		5
[CA]*Argiope blanda* O. P.-Cambridge, 1898, in 1889-1902:348	C		V		1m		1

Table 1. Continued.

Argiope trifasciata (Forskal), 1775: 86		G	V		1m		1
Cyclosa turbinata (Walckenaer), 1841: 140	C	G, H, M	V	7m 11f	1m 1f		20
Eustala californiensis (Keyserling), 1885: 525		G	V	1m 1f			2
Eustala conchlea (McCook), 1888: 99	D		V	1f			1
Hyposinga funebris (Keyserling), 1893: 37	A	G, H, K	V	4f			4
Larinia directa (Hentz), 1847: 478	C		V		1m		1
Metepeira crassipes Chamberlin & Ivie, 1942: 66	B, C, E, F	G, K	V, (P)	3m 2f	1m	1m	7
Clubionidae							
Cheiracanthium inclusum (Hentz), 1847: 451	A, D-F	H, K	V, (P)	3m 2f	1m 1f	1m 1f	9
Corinnidae							
Castianeira occidens Reiskind, 1969: 211	D	G, J, L, M	P	3m 6f	4m		13
Castianeira thalia Reiskind, 1969: 192	A-C	G, J-L	P	13m 6f			19
Corinna bajula Gertsch, 1942: 13	C, E	L	P	2m	1f		3
Meriola decepta Banks, 1895: 81		G	P	1f			1
Cybaeidae							
Cybaeus sp. #1 (#320)		G, K	P	1f		1f	2
Dictynidae							
[SD]*Blabomma sancta* Chamberlin & Ivie, 1937: 221		K, M	P			2m	2
Blabomma sp. #1 (#321)	C		P			1f	1
Blabomma sp. #2 (#239)	A, C		P			6m 1f	7
Blabomma sp. #3 (#302)	A		P			1m	1
Cicurina utahana Chamberlin, 1919: 257	A, B	G, H	P	2f		12m	14
Dictyna agressa Ivie, 1947: 2	A, D	G, M	P	8m 10f	1m 2f	1f	22
[SD]*Dictyna cholla* Gertsch & Davis, 1942: 12	A, C	M	P	3m 3f		1f	7
Dictyna sp. #1 (#237)	F		V	1f			1
[SD]*Emblyna consulta* (Gertsch & Ivie), 1936: 6	C-E	G	V	2m 2f		1m	5
Emblyna hoya (Chamberlin & Ivie), 1941: 7	D, E	G, I, K	V	15f			15
Emblyna linda (Chamberlin & Gertsch), 1958: 148	E		P	1f			1
Emblyna serena (Chamberlin & Gertsch), 1958: 134	C	G, L, M	V	1m 13f			14
[SD]*Tivyna moaba* (Ivie), 1947: 2	A, B		P	5f			5
[SD]*Tricholathys jacinto* (Chamberlin & Gertsch), 1958: 20	C		P	6m			6
Tricholathys monterea (Chamberlin & Gertsch), 1958: 22	B-D, F	G-L	P	20m 14f			34
Yorima angelica Roth, 1956: 4	A, C	G, L	P	26f			26
Diguetidae							
Diguetia canites (McCook), 1890, in 1889-1894: 135	C		V	1f			1

Table 1. Continued.

Dysderidae							
[NN]*Dysdera crocata* C. L. Koch, 1839: 81		G, K	P	3m 2f	4m 3f	2f	14
Filistatidae							
Filistatinella sp. #1 (#163)	A, B, D	H, L	P	27m 6f	1f		34
Filistatinella sp. #2 (#198)		G	P	5m			5
Gnaphosidae							
Callilepis eremella Chamberlin, in Cham. & Gertsch, 1928:177	A, B		P	3m			3
[SD]*Callilepis gosoga* Chamberlin & Gertsch, 1941: 10	B, C	G, M	P	23m 4f	11m 2f		40
Cesonia trivittata Banks, 1898: 220	A, D	G	P	2m	1m 1f		4
Drassyllus conformans Chamberlin, 1936: 22	C		P	3f			3
[SD]*Drassyllus fractus* Chamberlin, 1936: 14	E, F	G	P	4m			4
Drassyllus insularis (Banks), 1900: 97	A-F	G-M	P	132m 75f	76m 108f		391
Drassyllus lamprus (Chamberlin), 1920: 193	A, C	G, H	P	1m 9f			10
[SD]*Drassyllus saphes* Chamberlin, 1936: 29	D-F	G	P	2m 1f	1f		4
Gnaphosa californica Banks, 1904a: 335	C-F	G, I, K	P	9m	3m 1f		13
Herpyllus hesperolus Chamberlin, in Cham. & Gertsch, 1928: 176	B, C		P	2f			2
Herpyllus propinquus (Keyserling), 1887: 430	A		P	1m			1
[SD]*Micaria capistrano* Platnick & Shadab, 1988: 36	C	L	P	3f			3
Micaria deserticola Gertsch, 1933: 2	B, F	M	P	4m 2f		1m 1f	8
[SD]*Micaria icenoglei* Platnick & Shadab, 1988: 57	A-C	H, M	P	7m 6f	1m 1f		15
Micaria jeanae Gertsch, 1942: 4	A-F	J, L, M	P, (V)	6m 41f	2m 9f		58
Micaria utahna Gertsch, 1933: 3	B, C	G-I	P	24m 14f			38
Nodocion eclecticus Chamberlin, 1934: 613	C		P		1f		1
Scopoides kastoni Platnick & Shadab, 1976: 20	A, E		P		1m 1f		2
Sergiolus angusus (Banks), 1904: 337	A-C, E	G, J, L	P	14m 3f			17
Sergiolus gertschi Platnick & Shadab, 1981: 17	A, D	G, J-L	P	9m 1f	2f		12
Sergiolus montanus (Emerton), 1890: 175	A	G, J, M	P, V	3m	2f		5
[NN, SD]*Trachyzelotes barbatus* (L. Koch), 1866: 161	C		P	1m			1
[NN]*Trachyzelotes lyonneti* (Audouin), 1827: 383	A-C, F	G, H, K-M	P	9m 6f	15m 20f		50
[NN]*Urozelotes rusticus* (L. Koch), 1872: 309	A, B	G-I, K	P	4m	37m 16f		57
Zelotes gabriel Platnick & Shadab, 1983: 139	A, C, D		P	5m 4f			9
Zelotes gynethus Chamberlin, 1919: 7	A, C-F	G, H, J, L, M	P	9f	1m	26m 11f	47
Zelotes monachus Chamberlin, 1924: 621	A-F	G, H, J, L, M	P	71m 24f	4m 27f		126
[NN]*Zelotes nilicola* (O. P.-Cambridge), 1874: 380	A-C, E, F:	G, H, M	P	31m 22f	6m 6f		65

Table 1. Continued.

Halyniidae							
Calymmaria monicae Chamberlin & Ivie, 1937: 213		G	P	1f		3m 1f	5
Neoantistea santana Chamberlin & Ivie, 1942: 29	A, C, D	G, H, J	P		7m 1f	1f	9
Heteropodidae							
Olios schistus Chamberlin, 1919: 10		G	V	1f			1
Homalonychidae							
Homalonychus theologus Chamberlin, 1924: 631	A		P	1m			1
Linyphiidae							
[CA]*Ceraticelus phylax* Ivie & Barrows, 1935: 13		G-I, K-M	V	8m 13f		1m 8f	30
Ceraticelus sp. #1 (#7)	A-F	G-M	V, (P)	280m 822f	14m 401f	100f	1617
Erigone autumnalis Emerton, 1882: 58	A		V	1m			1
Erigone dentosa O. P.-Cambridge, 1894, in 1890-1902: 128	B		V	1m			1
Frontinella pyramitela (Walckenaer), 1841: 261	C, E	L	V	3m 2f			5
Idionella sclerata (Ivie & Barrows), 1935: 14		G, H, L, M	P	7m 1f		7m 3f	18
[SD]*Linyphantes aliso* Chamberlin & Ivie, 1942: 53	B, C	G, H, M	V, P	2m 9f	3f	8m 8f	30
Linyphantes sp. #1 (#236)	A, D	G, H	V, P	3m 1f	1f	4m 5f	14
Linyphantes sp. #2 (#220)		G, L	P			2m	2
Linyphantes sp. #3 (#221)	C, F	G, K, M	P			17m	17
Linyphantes sp. #4 (#342)		G	P	2f			2
Meioneta sp. #1 (#87)	C	G, K	P, (V)	4f			4
Meioneta sp. #2 (#53)	A-D, F	G, H, L, M	P	1m 1f		33m 6f	41
Microlinyphia mandibulata punctata Chamberlin & Ivie, 1943: 24		G	P	1f			1
Ostearius melanopygius (O. P.-Cambridge), 1879: 696	C		P	1m			1
Spirembolus phylax Chamberlin & Ivie, 1935: 19	A	G	P, V	1m		2m	3
[SD]*Spirembolus pusillus* Millidge, 1980: 128	A-F	H, K-M	P	1f		108m 21f	130
[SD]*Spirembolus tortuosus* (Crosby), in Chamberlin, 1925: 116	A-F	G, H, K-M	P			122m 2f	124
Spirembolus sp. #1 (#234)	A, D	L	P	1f		2f	3
Spirembolus sp. #2 (#341)	A		V	1f			1
[SD]*Tennesseellum formicum* (Emerton), 1882: 71	B, E		P, V	1m 1f			2
Liocranidae							
Agroeca trivittata (Keyserling), 1887: 444	C	I	P	1m 1f			2
Drassinella gertschi Platnick & Ubick, 1989: 5	C-F	G	P	4m 1f	1m 3f	2m 1f	12
[SD]*Phrurotimpus mateonus* (Chamberlin & Gertsch), 1930: 141	A-D, F	G-I, K-M	P	6m 100f		4m	110
Scotinella kastoni (Schenkel), 1950: 73	A, C	G, H, K-M	P	8f	2m	5m 6f	21
Lycosidae							
Alopecosa kochii (Keyserling), 1876: 636	B-F	G-M	P	11f		18m 9f	38

Table 1. Continued.

Pardosa californica Keyserling, 1887: 483	C, D, F	G, K	P, (V)	9m 12f	1f	6m 4f	32
Pardosa ramulosa (McCook), 1894, in 1889-1894, pl. 30	A		P	1m			1
Pardosa sierra Banks, 1898: 274	F		P	2f			2
Schizocosa maxima Dondale & Redner, 1978: 165		(I)	(h)				(1f)
Schizocosa mccooki (Montgomery), 1904: 283	A-F	G-L	P		25m 37f		62
Mimetidae							
Mimetus eutypus Chamberlin & Ivie, 1935: 63	A		V	1f			1
Mimetus hesperus Chamberlin, 1923: 5	C	G	V, P	1f	1f		2
Miturgidae							
Syspira synthetica Chamberlin, 1924: 665	A-F		P	14m 6f			20
Nesticidae							
Eidmannella pallida (Emerton), 1875: 297		G	P		1m		1
Oecobiidae							
[NN]*Oecobius annulipes* Lucas, 1849: 102	A-C, E	G, H, J, K	P, (V)	641m 168f	31m 43f	4f	887
Oonopidae							
[CA]*Opopaea bandina* Chickering, 1969: 144		G	P			1m 1f	2
Orchestina moaba Chamberlin & Ivie, 1935: 10	C	G	P	1m 8f			9
Scaphiella hespera Chamberlin, 1924: 594	A-F	G, H, J-L	P	11m 23f	3m 3f	3m 1f	44
Oxyopidae							
Oxyopes salticus Hentz, 1845: 196	A-D, F	G, H, J-M	V, (P)	23m 12f	7m 19f		61
Oxyopes tridens Brady, 1964: 472	A-D, F	G, H, M	V, P	7m 4f	1f		12
Peucetia viridens (Hentz), 1832: 105	C		V		1m		1
Philodromidae							
Apollophanes texanus Banks, 1904: 113		J	P	1f			1
Ebo evansae Sauer & Platnick, 1972: 41	C		V	1m			1
Ebo mexicanus Banks, 1898: 256	C		V			1f	1
Philodromus chamisis Schick, 1965: 50	A, C-F	G, I, K-M	V, (P)	4m 24f			28
Philodromus gertschi gertschi Schick, 1965: 53		G	V	2f			2
Philodromus quercicola Schick, 1965: 56		J	P	1m			1
Tibellus chamberlini Gertsch, 1933: 10	A-C	G, H	V, (P)	5m 8f	1f		14
Pholcidae							
Psilochorus sp. #1 (#103)	A-F	G-J, L	P	28m 18f	24m 17f	4m 7f	98
Plectreuridae							
Kibramoa guapa Gertsch, 1958: 38	D, E		P	1m 1f	1f		3
Plectreurys conifera Gertsch, 1958: 14	E	G	P	2m		1f	3
Plectreurys tecate Gertsch, 1958: 13	D		P	2m			2

Table 1. Continued.

Salticidae							
Habronattus californicus (Banks), 1904: 117	A-F	G, H, J-M	P, (V)	8m 50f	14m 46f	1f	119
Habronattus elegans (Peckham & Peckham), 1901: 201	C	G	P, V	1f	1f		2
Habronattus hirsutus (Peckham & Peckham), 1888: 64	D-F	L	V, (P)	1m	1m	1m 1f	4
Habronattus oregonensis (Peckham & Peckham), 1888: 66	D	G	P	1m 1f			2
Habronattus tarsalis (Banks), 1904: 118		G	P	1f			1
Metacyrba taeniola (Hentz), 1845: 353	A	G, K, L	P	5m	1f		6
Metaphidippus diplacis (Chamberlin), 1934: 686	A	G, H	V	2m 1f	2f		5
Metaphidippus mannii (Peckham & Peckham), 1901: 326		I, K-M	V	1m 3f			4
Metaphidippus vitis (Cockerell), 1894: 207	A-C, E	G-M	V, (P)	13m 27f	5m 4f	3m 7f	59
Peckhamia americana (Peckham & Peckham), 1892: 65	D	J	P, V	2f			2
Pellenes limatus Peckham & Peckham, 1901: 217		(I, J)	(h)				(1m, 3f)
Phanias sp. #1 (#81)		G	V	1f			1
Phidippus adumbratus Gertsch, 1934: 15		(I -2.6 km N)	(h)				(1f)
Phidippus californicus Peckham & Peckham, 1901: 289	D		V	1f			1
Phidippus johnsoni Peckham & Peckham, 1883: 22	C		V	1f			1
Phidippus octo-punctatus (Peckham & Peckham), 1883: 6	A		V		1f		1
Phidippus sp. #1 (#336)		J	P	1f			1
Salticus palpalis (Banks), 1904: 360	A, C-E	M	V, P	2m 5f			7
[SD]*Sarinda culteri* (Richman), 1965: 133	A		V	1m			1
[SD]*Sassacus papenhoei* Peckham & Peckham, 1895: 177	C-E		V	7m 2f			9
Sitticus dorsatus (Banks), 1895: 97	A-E	G, J-L	P	8m 9f	1f		18
Synageles noxiosus (Hentz), 1850: 288	D		P		1f		1
Synageles occidentalis Cutler, 1987: 343	A, D	L	V	3f			3
[SD]*Talavera minuta* (Banks), 1895: 99	C	G	P	2f	1f		3
Terralonus sp. (#1)	(E)		(h)				(1m)
Thiodina sp. #1 (#383)		H	V	1m			1
Scytodidae							
Scytodes sp.#1 (#157)		G	P	8m 2f	6m 2f		18
Tengellidae							
[SD]*Liocranoides dolichopus* (Chamberlin), 1919: 139	A, C, D	G, I, J, L	P	8m 1f		8m	17
Liocranoides sp. #1 (#104)	A, C, D	G, L	P	2m 1f	6m 4f		13
Theridiidae							
[SD]*Argyrodes fictilium* (Hentz), 1850: 282		(M)	(h)				(1f)
Crustulina sticta O. P.-Cambridge, 1861: 432		G	P	1f	1m 1f		3
[SD]*Dipoena abdita* Gertsch & Mulaik, 1936: 6	A-C, F	G, H, M	P	2m 1f	37m 28f	8m 6f	82

Table 1. Continued.

[SD]*Dipoena atopa* (Chamberlin), 1948: 541		M	P			1m	1
Dipoena prona (Menge), 1869: 177		L	P	1f			1
[SD]*Enoplognatha selma* Chamberlin & Ivie, 1946: 3		M	P	1f			1
Euryopis californica Banks, 1904: 345	B, E	M	V, P		3m 1f		4
[SD]*Euryopis spinigera* O. P.-Cambridge, 1895, in 1889-1902: 146		G, M	P	1m	1f	1f	3
Latrodectus hesperus Chamberlin & Ivie, 1935: 15	*	*	(h*)				*
Steatoda washona Gertsch, 1960: 21	A, B	G	P	2m 1f	1f		4
[SD]*Theridion cowlesae* Levi, 1957: 31	D		V	1f			1
Theridion dilutum Levi, 1957: 37	C-E	J	V	1m 6f			7
Theridion goodnightorum Levi, 1957: 41		G	V	1f			1
[SD]*Theridion intervallatum* Emerton, 1915: 136	A, B, D, E		V	2m 2f			4
[CA]*Theridion llano* Levi, 1957: 28	A-C, E, F	G-J, M	V, P	7m 14f	1m 1f	2m 1f	26
Theridion melanurum Hahn, 1931: (pl. 3, fig. a.)		(H, +SE corner)	(h)				(2m)
Theridion murarium Emerton, 1882: 11	B-D		V	2m 1f			3
Theridion punctipes Emerton, 1924: 29	A-D	G	V, (P)	1m 6f	3f		10
[SD]*Theridion rabuni* Chamberlin & Ivie, 1944: 53	A-C	G, L, M	V, (P)	4m 4f		1f	9
Theridion sp. #1 (#484)	C		V	1f			1
Thymoites expulsus (Gertsch & Mulaik), 1936: 9		M	V	2m			2
[SD]*Thymoites pallidus* (Emerton), 1913: 213		G, L	P		1m 1f		2
Thymoites sp. #1 (#514)		L	P		1f		1
Tidarren sisyphoides (Walckenaer), 1841: 321		H	V		1m		1
Thomisidae							
Coriarachne utahensis Gertsch, 1932: 5		L	V	1m			1
Misumenops aikoae Schick, 1965: 131		G	V	1m			1
Misumenops californicus (Banks), 1896: 91	E, F	H, K	V, (P)	2m 5f			7
Misumenops importunus belkini Schick, 1965: 131	F	G	V			2m	2
Misumenops lepidus (Thorell), 1877: 498		(M)	(h)				(1f)
Misumenops rothi Schick, 1965: 117	C, D, F	J	V	4m 1f			5
Xysticus californicus Keyserling, 1880: 37	E, F		P	3f			3
[SD]*Xysticus gulosus* Keyserling, 1880: 43		M	P			2f	2
Xysticus iviei iviei Schick, 1965: 164	A-C	G, K, M	P			19m	19
Xysticus nevadensis (Keyserling), 1880: 50	C, D		P	1m 2f			3
Xysticus pretiosus Gertsch, 1934: 6	A, B, D	G, H, K	P, (V)	12m 3f			15
Total				**3468**	**1255**	**693**	**5416**

[1] Regions A-F of MNAS (Fig. 1A), regions G-M of MCBCP (Fig. 1B). Bracketed letters indicate regions for hand collected species.

[2] P = collected by pitfall trap, V = collected by vacuum sample, (h) = hand collected (specimen numbers are bracketed and are not included in table totals). In instances where 'P' and 'V' are shown together, the species of reference was collected by both methods, but primarily by the method indicated by the first letter; bracketed second letter indicates that very few specimens were collected by that particular method.

[3] Number of specimens collected are recorded under each period, m=male, f=female.

[4] Number following an undetermined species number is the OTU reference number assigned to the particular species in our collection (i. e., *Aptostichus* sp. #1 (#118)).

[CA, NN, SD] (superscript to the left of listed species): CA = new species record for California, NN = non-native species, and SD = new species record for San Diego County, California.

* *Latrodectus hesperus* was observed in most geographic regions but adults were not collected (refer to 'Hand Collected Species' section in text).

and Oonopidae, Oxyopidae, and Plectreuridae (each with 3). All other families were represented by either one or two species.

Because only adults were included on our species list, consequently and unavoidably, all relative species abundance data in tables and text do not necessarily reflect actual relative abundance of species either present in samples or naturally occurring. However, family and species diversity data from our study were compared to diversity data provided in studies of monocultural ecosystems (Tilden 1951, Yeargan & Dondale 1974, Carroll 1980, Costello & Daane 1995) and other more complex ecosystems composed of mosaics of habitat types (Muma & Muma 1949, Barnes & Barnes 1955, Muma 1973, Griswold 1977, Jennings et al. 1988, Draney 1997) (Table 2). The lists of spider species collected in conventional monocultural agroecosystems (Table 2, studies in rows 8–11) clearly reflect lower species diversity than those of species collected in ecosystems composed of a mosaic of habitats (Table 2, studies in rows 1–7).

Species Collected in August 1996–December 1997 Samples.—Adults of two additional species were collected in samples from sites maintained at MNAS after the termination of our primary study in June 1996 (m = male, f = female): *Emblyna linda* (Chamberlin & Gertsch) (pitfall trap, May 1997, 1f) and *Phidippus californicus* Peckham & Peckham (vacuum sample, May 1997, 1f); juvenile *P. californicus* were very common in vacuum samples from the primary study. Females of three species (males collected during primary study) were also collected from these plots: *Argiope argentata* (Fabr.) (vacuum sample, Aug 1997, 1f), *Corinna bajula* Gertsch (pitfall trap, Aug 1996, 1f), and *Plectreurys conifera* Gertsch (pitfall trap, Dec 1996, 1f).

Hand Collected Species.—The following thirteen species were collected in CSS by hand at MNAS and/or MCBCP (designated in Table 1 by (h) under method of collection): *Araneus andrewsi* (Archer) (MCBCP: 11 Feb 1997, 2f; 17 Apr 1998, 1m), *Araneus detrimentosus* (O. P.-Cambridge) (MCBCP: 11 Feb 1997, 1f, 18 Feb 1997, 1f; 15 Apr 1998, 1f, 14 May 1998, 1f), *Argyrodes fictilium* (Hentz) (MCBCP: 18 Mar 1997, 1f), *Latrodectus hesperus* Chamberlin & Ivie, *Theridion melanurum* Hahn (MCBCP: 11 Feb 1997, 1m, 13 Feb 1997, 1m), *Misumenops lepidus* (Thorell) (MCBCP: 31 Mar 1997, 1m), *Schizocosa maxima* Dondale & Redner (MCBCP: 6 Apr 1998, 1f), *Pellenes limatus* Peckham & Peckham (MCBCP: 6 Feb 1997, 1m, 1f, 13 Feb 1997, 1f; 4 Apr 1998, 1f), *Phidippus adumbratus* Gertsch (MCBCP: 6 Apr 1998, 1f), *Terralonus* sp. (#1) (MNAS: 9 Dec 1997, 1m), *Aphonopelma steindachneri* (Ausserer): (Prentice 1997) (MNAS: 6 Jun 1997, 1f, 12 Aug 1997, 1f), *Aphonopelma* sp. ('*eutylenum* type': Prentice 1997) (MCBCP: 29 May 1996, 1f, 30 May 1996, 2f; 18 Mar 1997, 1f, 31 Mar 1997, 2f, 8 May 1997, 1f), *Bothriocyrtum californicum* (O. P.-Cambridge) (MCBCP: 18 Mar 1997, 1f); MNAS: 15 Jun 1998, 1f).

Although *L. hesperus* adults were not collected in study samples (juveniles were collected) nor by hand at either MCBCP or MNAS, Kaston (1970) reported it to be the only *Latrodectus* species occurring in southern California. In addition, one of us (TRP) has collected adults from several CSS communities in Riverside, San Bernardino, and San Diego counties. For these reasons *L. hesperus* is included on our species list and is here considered a prevalent CSS species.

Common Species.—Eight species were represented by >100 specimens which,

Table 2. Comparison of family and species diversity in coastal sage scrub spider fauna to that of spider fauna in other complex ecosystems (studies in rows 2–7) and in monocultural agroecosystems (studies in rows 8–11).

Study	Location	Habitats	Collection methods	Specimens examined	Families	Species
Present study	Southern California: San Diego Co.	Diegan CSS	pitfall and vacuum primarily, hand	14,587	36	200
Draney 1997	Georgia Piedmont	riparian fields and forest	pitfall primarily, vacuum/sweepnet, hand, unknown	—	26	145
Jennings et al. 1988	Northern Maine	spruce-fir forest: clearcut, residual strips, dence stands	pitfall trap	11,107	15(16)	~125
Griswold 1977	Northern California: Mendocino Co.	Inglenook Fen: littoral, beach, grassland, fen, fen carr, fen dune, dune	vacuum, sweepnet, hand collecting, sifting, beating and sweeping	>1000	17(20)	115
Muma 1973	Central Florida	sand-pine dunes, pine flatwoods, citrus, residential	pitfall trap	6307	22(23)	126
Barnes & Barnes 1955	Southeast. Piedmont: N & S Carolina, Georgia, Alabama	broomsedge, herbaceous level	sweepnet	5615	16(17)	85
Muma & Muma 1949	Nebraska prairie	prairie, wooded ravine	soil washer/Berlese funnel, hand sort, sweepnet, pitfall trap	5311	15(18)	111
Costello & Daane 1995	California: San Joaquin Valley: San Joaquin, Madera, Fresno counties	grape vineyards	beating and shaking	>11,000	14(15)	27
Carroll 1980	California: Fresno, Tulare, Riverside counties	citrus groves	beating, hand, vacuum, litter/Berlese funnel, pitfall trap	—	20(22)	60
Yeargan & Dondale 1974	Northern California: Yolo Co.	alfalfa fields	vacuum, pitfall trap, sweepnet, hand	14,552	14	36
Tilden 1951	California: Stanford U. campus primarily (spiders only)	*Baccharis pilularis consanguinea* De Candolle	—	—	8(12)	29

when summed, provided approximately 65% of the specimen total. These species are discussed below in order of decreasing relative abundance:

Ceraticelus sp. #1 (Linyphiidae): Vacuum samples from 59 plots provided 1617 specimens which comprised nearly 30% of the study total. *Ceraticelus* sp. #1 was collected in vacuum samples from all study plots except one at MNAS and frequently was collected with *C. phylax* Ivie & Barrows (1935). Adults occurred in all sampling periods but were most prevalent in May/June (68%) followed by August (26%). Approximately 45% of the specimens were collected from region A at MNAS (Fig. 1A) with two plots providing one-third of the specimen total. These latter plots were characterized as south facing slopes with few rocks and relatively dense shrub cover dominated by *Artemisia californica* Lesson (codominant with *Salvia apiana* Jepson in one plot and a minor shrub in the second) and *S. apiana* (dominant in the second plot). Minor shrub cover in both plots included *Mirabilis californica* A. Gray, *Baccharis sarothroides* A. Gray, and *Salvia mellifera* E. Greene, and ground cover consisted primarily of leaf litter, scattered annual grass, and patchy bare ground. *Ceraticelus* sp. #1 is orange in color with a dusky dorsoabdominal pattern. The males averaged approximately 1.55 mm and are equipped with a nearly complete dorsoabdominal sclerite. Females averaged approximately 1.65 mm in length and lacked a dorsal sclerite. Genitalia of both sexes are most similar to the respective genders of *C. phylax* but are consistently distinguishable from the latter by these characters and by the relative width and height of the cephalic region.

Oecobius annulipes Lucas (Oecobiidae): Pitfall samples from 30 plots provided 887 specimens (16% of the study specimens). Refer to 'Non-native species' section below.

Drassyllus insularis (Banks) (Gnaphosidae): Pitfall samples from 54 plots provided 391 specimens (7.2% of the study specimens). *Drassyllus insularis* was our most predominant (known) native species. It was absent only from particular plots along the coast (refer to Indications of Competitive Displacement by a Non-native Species section below). In California, *D. insularis* is known from 37 counties in northern to southern California (Platnick & Shadab 1982).

Spirembolus pusillus Millidge (Linyphiidae): Pitfall samples from 24 plots provided 130 specimens (2.4% of the study specimens). Collected almost exclusively in December samples and often with *Spirembolus tortuosus* (Crosby), *S. pusillus* occurred in all geographic regions except G, I, and J at MCBCP (Fig. 1B). The species is known from one locality in southern Oregon and from several counties in northern to southern California (Millidge 1980).

Zelotes monachus Chamberlin (Gnaphosidae): Pitfall samples from 39 plots provided 126 specimens (2.3% of the study specimens). The species was absent in samples from all lowland coastal plots in regions G and H (Fig. 1B) but occurred in samples from five S to SE facing hillslope plots (two and three plots in regions G and H, respectively). In California, *Z. monachus* is known from five southern counties (Platnick & Shadab 1983).

Spirembolus tortuosus (Crosby) (Linyphiidae): Pitfall samples from 36 plots provided 124 specimens (only two females) (2.3% of the study specimens). Collected exclusively in December samples, *S. tortuosus* occurred in samples from 66% of the plots with *S. pusillus* and in one additional geographical region (G) at MCBCP (Fig. 1B). *Spirembolus tortuosus* is known from one locality in north-

ern Oregon and several counties in northern to southern California (Millidge 1980).

Habronattus californicus (Banks) (Salticidae): Pitfall and some vacuum samples from 40 plots provided 119 specimens (2.2% of the study specimens). The species was least abundant or absent from densely shrubbed plots with either a disproportionate amount of bare ground or excessive leaf litter between shrubs. It is known only from eight counties in central to southern California (Griswold 1987).

Phrurotimpus mateonus (Chamberlin & Gertsch) (Liocranidae): Pitfall samples from 34 plots provided 110 specimens, 91% females (2% of the study specimens). *Phrurotimpus mateonus* was previously known only from San Mateo Co., California (Chamberlin & Gertsch 1930); Boe indicates additional records in Alameda, Contra Costa, Tulare, and Riverside counties.

New Species Records for California.—Changes in ecosystems may produce changes in fauna that are dependent on the adaptability of the species involved as well as on abiotic factors. Possible examples of faunal changes are suggested by the presence of species that are, for the first time, recorded from either the state of California or San Diego County, California. The following four species are here recorded as new species records for California (denoted by the superscript 'CA' in Table 1):

Argiope blanda O. P.-Cambridge (Araneidae): The previously known distribution of *A. blanda* extended from southern Texas to Costa Rica (Levi 1968). Our single male was collected in the north-central region of MNAS (Fig. 1A, region C) from a SE hillslope plot with a dense shrub canopy composed primarily of *Salvia mellifera* and *Adenostoma fasciculatum* Hooker & Arnott.

Opopaea bandina Chickering (Oonopidae): The description of *O. bandina* was based on a female from Pinellas Co., Largo, Florida; the other eight known specimens examined (females) had Florida locality data (Chickering 1969): one paratype, one from Aluachua Co., two from Edgewater, Florida (in MCZ), three from Lake Placid, and one from De Soto City (the latter four in AMNH); the male is undescribed. Our single male and female were collected in December 1994 and 1995, respectively, from a dense shrubby, northern lowland coastal plot at MCBCP (Fig. 1B, region G); this plot also provided one of the four highest specimens counts of *Zelotes nilicola* (O. P.-Cambridge). The major shrub canopy was composed of *Artemisia californica, Eriogonum fasciculatum* Bentham, and *Encelia californica* Nuttall; the ground cover was a mosaic of leaf litter and bare ground with few rocks.

Ceraticelus phylax Ivie & Barrows (Linyphiidae): The description of *C. phylax* was based on specimens from Chickasha, Oklahoma; the only other known collection localities were in Florida (Ivie & Barrows 1935) and near Lincoln, Nebraska (Muma & Muma 1949). Our specimens were collected only at MCBCP in May/June and August samples from 13 plots (generally, together with *Ceraticelus* sp. (#1) in the same samples). *Ceraticelus phylax* was found in all sampling regions except in the extreme northwestern corner of the base (Fig. 1B, region J). The species was most common in two coastal plots, 2.4 and 1.6 km (region H), respectively, from the ocean, which both yielded a nearly equal number of specimens. These were the same plots that provided the greatest and second greatest numbers, respectively, of *Zelotes nilicola* specimens, the former plot also pro-

viding the male of *Metaltella simoni* (Keyserling) and the latter plot providing the second greatest number of *Urozelotes rusticus* specimens. *Ceraticelus phylax* was also collected, with *Ceraticelus* sp. #1, from a non-study area near Temecula, California on *Artemisia californica.*

Theridion llano Levi (Theridiidae): Known otherwise from Texas (Llano and Starr counties) (Levi 1957), *T. llano* was collected in 19 plots at both MCBCP and MNAS, but primarily from 13 plots at the latter (Figs. 1A, 1B). *Eriogonum fasciculatum, Baccharis sarothroides, Salvia apiana, Adenostoma fasciculatum,* and *Yucca whipplei* Torrey were often associated with those plots yielding the greatest numbers of specimens.

New San Diego County Records.—Thirty-five species are new records for San Diego County (indicated in Table 1 by the superscript 'SD'); the majority of these species have been recorded from adjacent or other neighboring counties. County listings are provided here for seven species (including non-native species) that were collected only in counties north of and including Santa Barbara County: *Araneus detrimentosus* (O. P.-Cambridge): Monterey and Santa Barbara counties (Levi 1973), *Blabomma sancta* Chamberlin & Ivie: Santa Barbara County (Chamberlin & Ivie 1937), *Trachyzelotes barbatus* (L. Koch): Contra Costa and Marin counties (Platnick & Murphy 1984), *Argyrodes fictilium* (Hentz): Marin, Monterey, Santa Clara, and Santa Cruz counties (Exline & Levi 1962), *Dipoena atopa* (Chamberlin): Fresno Co. (Levi 1953), *Euryopis spinigera* O. P.-Cambridge: Mono, Santa Barbara, and Sonoma (?) counties (Levi 1954), *Theridion intervallatum* Emerton: Santa Barbara, Santa Cruz, and Monterey counties (Levi 1957).

Undescribed Species.—Twenty of the 200 species collected are believed to be undescribed, 19 araneomorph and one mygalomorph species. They are as follows: *Cybaeus* sp. #1 (Cybaeidae), *Blabomma* sp. #2, #3 (Dictynidae) (*Blabomma* sp. #1 is probably the female of sp. #3 male; the status of the *Cybaeus* and *Blabomma* species was determined by D. Ubick (CAS)), *Filistatinella* sp. #1, #2 (Filistatidae), *Ceraticelus* sp. #1 (Linyphiidae), *Linyphantes* sp. #1, #2, #3 (Linyphiidae) (species #4 is probably the female of either species #2 or #3 male),*Meioneta* sp. #1, #2 (Linyphiidae), *Psilochorus* sp. #1 (Pholcidae), *Phanias* sp. #1 (Salticidae), *Terralonus* sp. #1 (Salticidae), *Thiodina* sp. #1 (Salticidae) (the status of the former two salticids was determined by W. Maddison (University of Arizona, Tucson)), *Scytodes* sp. #1 (Scytodidae), *Liocranoides* sp. #1 (Tengellidae) (the status of the *Liocranoides* species was determined by D. Ubick (CAS)), *Theridion* sp. #1 (Theridiidae), *Thymoites* sp. #1 (Theridiidae), *Aptostichus* sp. #1 (Cyrtaucheniidae) (the status of the *Aptostichus* male was determined by J. Bond (Virginia Polytechnic Institute and State University)).

Rare Species.—The following three species from CSS samples are here considered rare:

Opopaea bandina Chickering (Oonopidae): This species was discussed above in the 'New species records for California' section. Based on the measure of a limited number of known specimens (Chickering 1969), *O. bandina* should be considered rare.

Micaria capistrano Platnick & Shadab (Gnaphosidae): The description of this species was based on a female (holotype) from Orange Co., California, near the Riverside Co. line, "12 mi. E of Capistrano". Only one additional female from the U.S.A. (Box Springs Mountain Park, Riverside Co., California) and four fe-

males from Baja California (San Jose) were previously known (Platnick & Shadab 1988). Two of our three females were collected at MNAS (Fig. 1A, region C), the third was collected at MCBCP (Fig. 1B, region L); the male remains unknown. Based on the measures of a limited number of known specimens and an unknown male, *M. capistrano* should be considered rare.

Micaria icenoglei Platnick & Shadab (Gnaphosidae): The species description was based on a male holotype and female allotype from Winchester, Riverside Co., California; only five additional specimens were known, (2 males, 3 females), also from Winchester (Platnick & Shadab 1988). We collected 15 specimens, 8 males and 7 females, from nine plots, six at MNAS and three at MCBCP (Table 1; Figs. 1A, 1B). Even though several additional specimens have now been collected, all known *M. icenoglei* material has come from CSS ecosystems. In light of the apparently limited distribution of the species, the general concern over the status of the species habitat, and the limited number of specimens in hand, *M. icenoglei,* should be considered rare.

Non-native Species.—The following seven non-native species were collected in CSS samples and are discussed below in order of decreasing relative abundance (denoted by the superscript 'NN' in Table 1). The first four species listed, *O. annulipes, Z. nilicola, U. rusticus,* and *Trachyzelotes lyonneti* (Audouin) were among the top twenty most frequently collected species. *Urozelotes rusticus, Dysdera crocata* C. L. Koch and *O. annulipes* are considered synanthropic species; *U. rusticus* and *O. annulipes* are also considered cosmopolitan.

Oecobius annulipes Lucas (Oecobiidae): Origin unknown, *O. annulipes* is distributed within the USA primarily in coastal and gulf states (Tennessee and Arizona are exceptions). Its establishment "out-of-doors" only in the southwestern part of the United States and south into Mexico (Shear 1970), suggest the species' non-native origin. The species is apparently widely distributed in CSS at MNAS and in the western half of MCBCP, but occurred in only about half of the plots within each base; approximately 70% of the specimens were from coastal plot at MCBCP (Fig. 1B, region G). It was predominantly collected in May/June samples (91%); only four females were collected in December samples. *Oecobius annulipes* was the most common pitfall species. Refer to 'Common species' section above.

Zelotes nilicola (O. P.-Cambridge) (Gnaphosidae): A Mediterranean species, *Z. nilicola* is known only in the USA from southwestern Arizona and five southern California counties (in San Diego County, as early as 1955) (Platnick & Shadab 1983). It was previously collected at MCBCP "8 mi. N Oceanside" by Gertsch, Ivie, and Schrammel, 30 Mar 1960 (Platnick & Shadab 1983). Although we collected the species at both MNAS and MCBCP (May/June and August samples), over 65% of the specimens were in samples from MCBCP and of these, approximated 75% were from plots within 2.4 km of the coast and between 21 and 26 km N of Oceanside. Two plots (Fig. 1B, regions H, G) with the second and third highest specimen counts, respectively, provided the second and first highest counts, respectively, of *U. rusticus.* At MNAS, *Z. nilicola* was sparsely distributed in all regions except the northwestern quarter of the eastern third of the base. The species was collected in 19 plots and was the tenth most common pitfall species and the eleventh most common species from combined sampling methods.

Urozelotes rusticus (L. Koch) (Gnaphosidae): Origin unknown, *U. rusticus* has

a worldwide distribution although it is apparently absent in Australia and New Zealand (Platnick & Murphy 1984). It is now reported in the USA in at least twenty states and, in California, in thirteen counties (in Los Angeles County, as early as 1904) (Platnick & Murphy 1984). In our study, *U. rusticus* was collected in ten plots primarily at MCBCP (only two males from MNAS), with more than 80% of the specimens coming from three lowland plots near the installation's northern coastal boundary, within 1.6 km of the ocean (Fig. 1B, regions G, H). No specimens were taken from northwestern, northeastern, and eastern plot clusters at MCBCP (Fig. 1B, regions J, L, M). *Zelotes nilicola* was found in 70% of the plots in which *U. rusticus* occurred. *Urozelotes rusticus* was the sixteenth most common species from combined sampling methods.

Trachyzelotes lyonneti (Audouin) (Gnaphosidae): A Mediterranean species, *T. lyonneti* has been recorded in Illinois, Missouri, Texas, and 12 counties in California (from Solano County to San Diego County; in Santa Clara County, as early as 1924) (Platnick & Murphy 1984). More widely and evenly distributed than *U. rusticus* at both MCBCP and MNAS, *T. lyonneti* was collected in relatively even numbers from 19 plots, 14 of which were at MCBCP. Ten of these 14 plots were coastal (Fig. 1B, regions G, H), providing over 65% of the specimen total. The species was not collected in regions D and E of MNAS nor in regions I and J of MCBCP. It was found in 70% and 37%, respectively, of the plots in which *U. rusticus* and *Z. nilicola* occurred. *Trachyzelotes lyonneti* was the seventeenth most common species from combined sampling methods.

Trachyzelotes barbatus (L. Koch) (Gnaphosidae): Distributed from Spain to Yugoslavia, *T. barbatus* has been recorded in the USA only in California (Contra Costa County, 1980, and Marin County, 1982) (Platnick & Murphy 1984). We found a single male in a June pitfall sample from the central region of MNAS (Fig. 1A, region C) which represents a new record of this species for San Diego County. *Zelotes nilicola* was also taken from the same plot.

Metaltella simoni (Keyserling) (Amaurobiidae): Originating in Argentina and Uruguay, *M. simoni* was first recorded in the USA in Louisiana in 1944 (Leech 1972). Since then, distribution records indicate its occurrence also in Mississippi, Florida, North Carolina, California, and in Alberta, Canada (Leech 1972, Vetter & Visscher 1994). We collected a single male at MCBCP from a northern coastal plot approximately 2.4 km inland from the ocean (Fig. 1B, region H); this plot also provided *O. annulipes, U. rusticus,* juvenile *Trachyzelotes* and *D. crocata,* and the greatest number of *Z. nilicola* specimens.

Dysdera crocata C. L. Koch (Dysderidae): Widely distributed in the United States, *D. crocata* is recorded in California from San Diego to Placer County. All adults (except three females) and the vast majority of juveniles were collected in samples from northern coastal plots at MCBCP (Fig. 1B, region G). Two plots yielding the largest number of specimens (adult and juvenile) were within 500 and 600 m, respectively, of the coast, the former also provided *O. annulipes, T. lyonneti,* the third highest *Z. nilicola* count, and the highest *U. rusticus* count.

Regional Distribution of Non-native Species.—The distribution of five of the non-native species, *Z. nilicola, U. rusticus, T. lyonneti* (Gnaphosidae), *O. annulipes* (Oecobiidae), and *D. crocata* (Dysderidae) was highly concentrated in regions along the MCBCP coast (Fig. 1B, regions G, H). All five species co-occurred in four plots, two plots each in regions G and H. These four plots provided

the three greatest *U. rusticus* and greatest *Z. nilicola* specimen counts. One of the H plots provided the *Metaltella simoni* male and juvenile *Trachyzelotes*; both H plots provided juvenile *D. crocata.* Interestingly, these latter plots also contributed a substantial percentage of the non-native Argentine ant (*Linepithema humile* (Mayr)) specimens in pitfall samples.

Common to all four plots was their lowland coastal location and close proximity to roads routinely traveled by military personnel. The two G plots were located 500–600 m from the coast, between the I-5 Freeway and a frontage road to the east (within 40 m of frontage road). They were characterized by relatively tall, dense shrub cover. The two H plots were located approximately 1.6 and 2.4 km, respectively, from the coast and approximately 1.5 km from military housing at San Onofre. These plots were characterized by an open, patchy shrub canopy with an annual grass/forb understory.

Indications of Competitive Displacement by a Non-native Species.—The native gnaphosid species, *Drassyllus insularis,* occurred in all except six coastal plots. Three of these plots provided the highest specimen counts of *U. rusticus* (19, 17, and 13, respectively); all non-adult *Drassyllus* collected from these plots were penultimates of smaller species (most likely *D. lamprus* (Chamberlin) and *D. fractus* Chamberlin). In five of seven plots where the species co-occurred, only one *U. rusticus* specimen per plot was found in samples; in a sixth plot, only two were found. From the seventh plot (coastal), five *U. rusticus* were collected in addition to nine *D. insularis.* However, in the only other two coastal plots in which the species co-occurred, samples yielded substantially more *D. insularis* (12 and 18 specimens) than *U. rusticus* (2 and 1 specimen). *Drassyllus insularis* was abundant (10–25 specimens per plot) in several coastal plots in which *U. rusticus* was absent from samples. These data suggest to us that *U. rusticus,* when abundant in a given region, has displaced or is locally displacing *D. insularis.*

Sampling Biases and Associated Observations.—Relative size differences between spider and pitfall funnel diameter and the sedentary nature of both burrowing species and a number of ground dwelling web builders are two probable reasons for the absence of certain taxa in pitfall samples. The overall size and leg span of many mygalomorphs and relatively large araneomorph species may either enable them to negotiate the traps or to facilitate their escape (especially true of those species endowed with extensive tarsal scopulae). Females of burrowing araneomorphs, such as *Geolycosa,* some *Lycosa,* and *Kukulcania,* and mygalomorphs rarely, if ever, wander far from the confines of their burrows, thereby avoiding the traps.

One of three likely behavioral explanations for bias in vacuum sampling is the preference of certain spiders (i.e., *L. hesperus*) for subterranean retreats or other crevices that impede the effectiveness of the vacuum. The second involves the habit of many aerial web builders and various arboreal hunters and ambushers to drop or jump suddenly from their positions under conditions of abnormally strong vibration, such as a vacuum tube would create when moved through the shrub layer. Thirdly, several species (i.e., *Olios*) likely to be taken by the vacuum sampling method when active, are nocturnal, hiding in crevices or beneath rocks by day when vacuuming was performed. A fourth bias in vacuum sampling involves the inherent ties between spider and web that prevent the vacuum from pulling a spider from a strong web or from breaking the web free from its attachment points.

This may, in part, account for the absence of larger spiders such as *Araneus gemma* (McCook), *Neoscona crucifera* (Lucas), and *L. hesperus* from our samples.

Obvious to anyone interested in taxonomic surveys is the fact that no species list is ever complete. All possible biases cannot be controlled for when employing any given sampling method. We are not familiar enough with the behavior and biology of most spider fauna to know exactly what measures are necessary to maximize collections; hence, many co-occurring species may be left undiscovered (i.e., hand collected species on our list) during even the most intensive sampling efforts. Nevertheless, the faunistic list presented here is the most complete and comprehensive developed for this ecologically sensitive region of the country.

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